

8. Behaviour of the materials in exploitation

GENERAL INFORMATION ABOUT THE COURSE		
Course coordinator	Sanja Šolić, PhD, associate professor	
Course name	Behaviour of the materials in exploitation	
Study program	Mechanical Engineering	
Course status	Compulsory	
Year	1	
Semester	2	
Number of credits and teaching methods	ECTS student load coefficient	6
	Number of hours (lectures + seminars + exercises)	30 + 15 + 15

1. DESCRIPTION OF THE COURSE

1.1. Course objectives

The aim is to present the fundamental principles of material behaviour in all phases of exploitation, reactions and behaviour in conditions of various wear mechanisms. Special attention is given to identifying the types and causes of fractures and identifying the types of wear mechanisms and procedures to minimise them for the purpose of reducing wear to a minimum.

1.2. Course enrolment prerequisites (*if applicable*)

None

1.3. Expected course learning outcomes

After having listened to all course lectures and passed the exam, students will be able to:

1. Assess and identify the basic causes of mechanical parts malfunctioning
2. Classify and describe the procedure for analysing faults in mechanical parts
3. Identify the types of breakages of mechanical parts
4. Determine and elaborate the types of wear mechanisms
5. Differentiate and formulate the consequences of action from continual static and dynamic loads
6. Foresee the wear of a machinery part in use and select the optimal solution for minimising consequences of wear in the use of a mechanical part

1.4. Course content

1. Causes of mechanical parts malfunctioning
2. Procedure for analysing faults
3. Fundamentals of fracture mechanics
4. Ductile – brittle failure. Fracture toughness.
5. Fundamentals of fractography. Macro and micro analysis of the fractured surface
6. Material fatigue process. Fracture, consequences of material fatigue
7. Malfunctioning of mechanical parts due to plastic deformation (warping)
8. Malfunctioning of mechanical parts due to increased and high work temperature
9. Overview of malfunctioning based on type of mechanical part
10. Fundamentals of tribology. Wear mechanisms
11. Malfunctioning of mechanical parts due to various wear mechanisms
12. Description of process of corrosion and stress corrosion
13. Malfunctioning of mechanical parts due to corrosion and stress corrosion
14. Hydrogen sickness
15. Malfunctioning of mechanical parts due to technological defects

1.5. Types of teaching	<input checked="" type="checkbox"/> Lectures	<input checked="" type="checkbox"/> Autonomous exercises
	<input checked="" type="checkbox"/> Seminars and workshops	<input type="checkbox"/> Multimedia and network
	<input checked="" type="checkbox"/> Exercises	<input checked="" type="checkbox"/> Laboratory
	<input type="checkbox"/> Distance learning	<input type="checkbox"/> Mentor assistance
	<input checked="" type="checkbox"/> Field work	<input type="checkbox"/> Other types

1.6. Comments

1.7. Student obligations (*attendance at classes, lectures, tutorials, seminars*)

Attendance at lectures and exercises. Work in the laboratory as well as autonomously drafting and presenting the seminar paper.

1.8. Tracking student work (proportion of individual activities in terms of ECTS credits based on the total number of ECTS credits)

Class attendance	2	Class participation		Seminar paper		Experimental work	0,5
Written exam	0,5	Oral exam	0,5	Essay		Research	0,5
Project	1,5	Continual assessment of knowledge		Written seminar paper		Practical work	0,5
Online activity							

1.9. Grading and assessment of student work during the semester and for the final exam (*interim exam, written exam, oral exam*)

Three interim exams as well as the drafted and defended seminar paper.

1.10. Mandatory literature (relevant at the time of submitting the proposed study program)			
<ul style="list-style-type: none"> - Gwidon W. Stracowiak: Wear: Materials, Mechanisms and Practice, Wiley, 2006 - Derek Hull: Fractography: Observing, Measuring and Interpreting Fracture Surface Topography, Cambridge University Press, 1999 			
1.11. Supplementary literature (relevant at the time of submitting the proposed study program)			
- J. R. Davis: Surface Engineering for Corrosion and Wear Resistance, ASM, 2001			
1.12. Manner of tracking quality to ensure the acquisition of exit knowledge, skills and competences			
Through the organised quality system at the university, student survey			
2. COMBINING THE LEARNING OUTCOMES, TEACHING METHODS AND ASSESSMENT OF THE LEARNING OUTCOMES			
<i>2.1. Class participation</i>	<i>2.2. Student participation</i>	<i>2.3. Learning outcome</i>	<i>2.4. Assessment method</i>
Lectures	Analysis of professional texts, synthesis of knowledge and presenting them through actively following lectures and presenting what has been learnt	1 - 6	Filling out the online self-assessment forms and periodical reports (10% of points). Continual assessment of knowledge (50% of the points)
Seminar paper	Searching literature, selecting and explaining seminar paper topic, writing the seminar paper, presenting the seminar paper, participation in evaluation	1 - 6	Writing up and presenting the topic and actual seminar paper (30% of the points)
Exercises	Participation in conducting laboratory tasks, preparing samples, analysis of conclusions	1 - 6	Evaluating and analysis of all set and resolve tasks as well as drawn conclusions (10%)